REMARKS:

Applicant appreciates the time and care the examiner has taken in examining the application.

In the Amendments. It is noted that the Advisory Action states that the amendments presented in the Response to Final Office Action have not been entered. Therefore, such amendments are presented again. Claim 1 has been amended to add the limitation *as it enters the housing of the kiln system (20)* at the end of the claim. Support for this amendment is found in the original specification at, among other places, paragraph |0048|; original claim 37 in the national phase; and original claim 40 and amended claim 37 in the international phase. No new matter is presented.

Claim 23 has been found allowable if rewritten in independent form containing all of the limitations of the base claim and intervening claims. Accordingly, in the amendment above, claim 23 has been rewritten as an independent claim. The only change made in this rewriting was to add the descriptor "*for mixing*" to the term "system" to better distinguish the invention, namely the system for mixing, from the gas supply systems that the system for mixing comprises.

Allowable Claims. It is submitted that claims 23-26 should now be allowed, the last remaining objection having been addressed by the amendment presented above.

On the Rejections. All contents of the prior Responses to Office Action are herein incorporated by reference. It is respectfully submitted that the cited references, Hansen and JP 5223228, taken separately or in combination, fail to anticipate or render obvious the invention as claimed.

Applicant points out that the claim limitation "... *wherein said injector (84,86) is provided with swirling means for providing axial swirl to said injected gas...*" clearly defined that the stream of the injected gas itself is caused to rotate about its axis of injection, because, according to this wording, the axial swirl is provided to the injected gas, and not to the process gas flow. But to even further define this point in view of the examiner's comments in the final Office action, the above amendment to claim 1 is presented in order to add the wording "*as it enters the housing of the kiln system (20)*" to the clause, so that the clause now provides as follows:

> ***"...wherein said injector (84,86) is provided with swirling means for providing axial swirl to said injected gas as it enters the housing of the kiln system (20)."***

When considering the amended wording of this claim, it is clear that when axial swirl is provided by the swirling means to the injected gas as it enters the housing of the kiln, the jet of injected gas is caused to rotate about its **own** axis of injection. This feature is hence even more clearly incorporated as an explicit limitation of the claims than in the prior version of claim 1.

The structure of the swirling means (100) and the specific advantages of the swirling means (100) are described in the original specification herein:

> ***[0109] As described above, the SAS 82 is provided to inject a high momentum, swirling turbulent stream of air (or other gases) into the stratified gas and particle process gas flow at an area having a temperature of approximately 850-1400 degree C in a kiln 42, gas riser 34, precalciner 58, or***

the like, in order to mix the process gas flow, remove the stratification and improve combustion and gas-to-particle heat transfer, making better use of available oxygen. The additional air--usually with a momentum level similar to that of the main process gas flow--arrives via injector(s) 84 or 86, designed specifically for the plant concerned.

[0110] In a preferred embodiment, the injectors 84 and 86 may also be configured to induce swirl or turbulence in the injected gases and thereby enhance entrainment of the process gas flow. FIGS. 4 and 5 show alternative arrangements of the peripheral SAS 94, in which swirl vanes 100 are included within the injectors 84 and 86. The injectors 84 and 86 may also be provided with a bluff body (not shown) or flare diffuser (not shown). A bluff body is a centrally located solid disc or cone near the exit of the injector 84 or 86 of slightly smaller maximum diameter than the injector 84 or 86. The bluff body or flare diffuser additionally enhances jet entrainment.

[0111] There are several advantages that may be observed when using a SAS 82 with a typical process gas flow. By way of example, the Reynolds number, which indicates turbulent flow and mixing, is expected to be approximately 2.5 times higher at some $7.5*10^5$ than in a typical main process gas flow, hence increasing turbulent mixing. In addition, the minimum eddy size is expected to be approximately 50 times smaller, that is, less than the size of particles of pulverized coal and raw material (around 3 microns), hence increasing heat transfer for both combustion and calcination. The turbulent frequency, which indicates the rapidity of eddy fluctuations, is also expected to be generally increased by approximately 100 times or more from perhaps $1.5*10^5$ sec^{-1} to $5*10^7$ sec^{-1}, again facilitating mixing, combustion and heat

transfer. Moreover, the jet entrainment and mixing due to the swirl vanes 100 and/or flare diffuser or bluff body is expected to be approximately 2.5 times higher in a specific distance than for injection without such elements at the same velocity, hence the amount of air and fan pressure can be lower for the same effect and give a more beneficial impact on both the installation and the process.

The examiner's comments reveal an error in the rejection, which resides in the failure to distinguish between the overall rotational movement of the process gas flow about the longitudinal axis of the kiln (as in the cited prior art references), and the axial swirl that is imparted by the swirling means (100) to the jets of injected air (as in the claims herein). In particular, the difference between the reference JP 5223228 and claim 1 herein lies in the swirling means (100) of claim 1 comprised as part of the structure of the injectors, for providing axial swirl to the injected gas as it enters the housing of the kiln system. The swirling means feature is present in every independent claim in this application.

In contrast, the injected gas in JP 5223228 does not enter the housing with an axial swirl. The injectors in JP 5223228 do not have any swirling means. In the final action and the advisory action, the examiner refers to C3 in Fig. 1 of JP 5223228 to support the rejection. C3 is an arrow representing the direction of injection. C3, however, does not in any way show a swirling effect of injected gas as it enters the housing. JP 5223228 merely shows in Fig. 1a a swirling effect of the process gas flow along the longitudinal axis of the kiln, which is achieved by arranging the central axis of the nozzles for introducing secondary air to be tangential to a circle concentric to the axis of the kiln. JP 5223228 does not disclose a jet of injected air that has an axial swirl when it enters the housing, and fails to teach or suggest any swirling means in the injectors.

The advantage of the structure comprising the swirling means (100), as claimed herein, is that the gas flow can be controlled in a more precise way. This is due to the fact that the injected

gas provided with an axial swirl by the swirling means (100) will keep its momentum for a longer period of time before losing it to the process gas flow in the kiln. In particular, when the injected gas hits the process gas flow, whose flow is already highly turbulent, the injected jet of gas can be formed in a more precise way. This swirling means structure and this second swirl of the injected gas is neither mentioned in the abstract of JP 5223228, nor can it be inferred from Fig. 1a.

It is noted that, contrary to the examiner's findings, the nozzles shown in FIGS. 8a and 8b of U.S. Pat. No. 6,672,865 are not able to impart rotational momentum (swirling) to the jets of injected air. The shown nozzles are merely slots, causing, at best, a turbulent exit of the injected gases; it cannot be seen how these slots could impart a rotational movement to the jets. It is clear that the nozzles of Hansen are not injectors provided with swirling means for providing axial swirl to the injected gas as it enters the housing of the kiln system.

It is hence clear that the independent claims of the present application define the invention as novel and non-obvious over the cited art. Considering the advantages of imparting rotational movement to the jets of injected gas themselves as they enter the housing with the swirling means provided to the injectors, it is clear that the subject matter of the present application is neither anticipated by nor rendered obvious by the cited references.

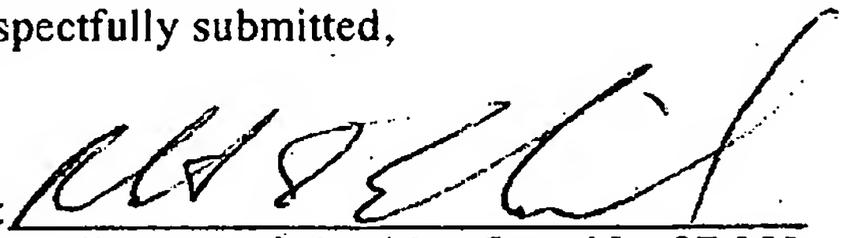
Therefore, it is respectfully submitted that all the rejections should now be reconsidered and withdrawn.

It is thus respectfully submitted that this application is in condition for prompt allowance; and that all of the objections, rejections and requirements raised in the Office action have been met. Early, favorable treatment of this application is requested.

The examiner is encouraged to telephone the undersigned with any questions or comments so that efforts may be made to resolve any remaining issues.

Extension Request and Deposit Account Charge Authorization. The Commissioner is hereby authorized to charge any required fees, or credit any overpayment, associated with this communication, including fees for any necessary extension of time under 37 CFR §1.136(a) for filing this communication, which extension is hereby requested, to our Deposit Account No. 50-0305 of Chapman and Cutler LLP.

Respectfully submitted,

By: 
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CERTIFICATE OF FACSIMILE TRANSMISSION UNDER 37 C.F.R. § 1.8

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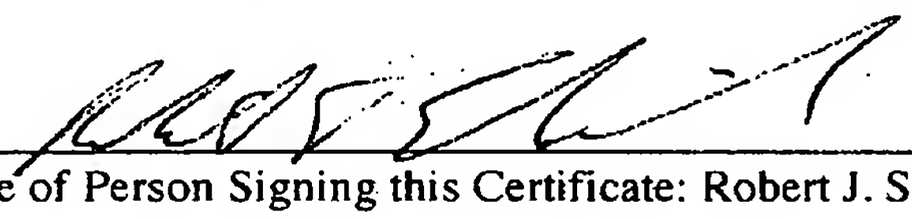
I hereby certify that the attached correspondence, namely: Reply and Amendment with RCE, was transmitted by facsimile on the date listed above, to the U.S. Patent Office at the facsimile number listed above, under 37 C.F.R. § 1.8.

Signature: 
Typed Name of Person Signing this Certificate: Robert J. Schneider

Date of Signature: June 22, 2009